Our Docket No.: 42P16889

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:		
Richard D. Emery	Examiner:	NGUYEN, DILINH
Application No: 10/608,718	Art Unit:	2814
Filed: June 27, 2003		
For: Fabrication of Microelectronic Devices		

Mail Stop Appeal
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF
IN SUPPORT OF APPELLANT'S APPEAL

Sir or Madam:

Appellant hereby submits this Brief in support of its appeal from a Final Office Action by the Examiner, mailed January 25, 2005, and an Advisory Action Before the Filing of an Appeal Brief, mailed May 2, 2005, in the above-referenced Application. Appellant respectfully requests consideration of this appeal and the allowance of the above-captioned patent application.

An oral hearing is not requested.

FIRST CLASS CERTIFICATE OF MAILING

I hereby certify that I am causing the above-referenced correspondence to be deposited with the United States Postal Service as first class mail with sufficient postage on the date indicated below and that this paper or fee has been addressed to the Commissioner of Patents, P.O. Box 1450 Alexandria, VA 22313-1450.

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TABLE OF CONTENTS

(i) REAL PARTY IN INTEREST

The invention is assigned to Intel Corporation of 2200 Mission College Boulevard, Santa Clara, California 95052.

(ii) RELATED APPEALS AND INTERFERENCES

To the best of Appellant's knowledge, there are no appeals, interferences, or judicial proceedings related to the present appeal that are related to, will directly affect, will be directly affected by, or will have a bearing on the Board's decision.

(iii) STATUS OF THE CLAIMS

Claims 1, 3-10, and 31-37 are currently pending in the above-referenced application, with claims 2 and 11-30 being canceled. In the Final Office Action mailed January 25, 2005, claims 1, 3, 4, and 6-10 were rejected, 5 was objected to, and claims 31-37 were allowed. The Advisory Action mailed May 2, 2005 has modified the claim status, with claims 1, 4, 6, and 7 being rejected, claims 3, 5, and 8-10 being objected to, and claims 31-37 being allowed.

Claims 1, 4, 6, and 7 are reject rejected under 35 U.S.C. §102 (e) as being anticipated by U.S. Patent No. 6,787, 899 of *Rinella* (hereinafter referred to as *Rinella*). The Examiner has objected to claim 5 as being dependent upon a rejected base claim. The reason for the objection regarding claims 3 and 8-10 has not been articulated in the record, but it is assumed that the Examiner has objected to such claims on the same basis as claim 5, and that such claims are thus allowable if the base claim is allowed.

(iv) STATUS OF AMENDMENTS

No amendments are currently pending. Appellants filed a timely Notice of Appeal on April 25, 2005.

(v) SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention generally relates to microelectronic devices, and specifically to a microelectronic device that affects expansion characteristics. (See Field of the Invention, ¶ 0001).

An embodiment of the invention may be understood by referring to Figures 2 and 3 and the supporting text of the specification. In Figure 2, a package 200 is illustrated, with the package including solder bumps 220 to provide a connection to the die 240. The package 200 may include a first plate 225, which in this instance surrounds the die 240. In this illustration, the first plate 225 is coupled with the die 240 by a material, such as a stiff solder, that provides a secure physical connection. (*See* Description, ¶0028) In this illustration, the first plate 225 modifies the apparent coefficient of thermal expansion. In one example, as temperatures increase and the first plate 235 expands, the die 235 is forced to expand by the forces pulling on the die 235 at the points of attachment between the die 235 and the first plate 225 on the edges of the die 235. The package may also include a second plate 230 that is coupled with the package 200 by an adhesive, with the connection to the second plate modifying the coefficient of thermal expansion of the package. (*See* Description, ¶0029)

Figure 3 then illustrates an embodiment of the invention that includes a package 300 again with a die 340. In this embodiment of the invention, a first plate 325 is coupled with the die 340, in this instance is coupled with one side (such as the inactive side) of the die 340. The coupling is accomplished using a material providing a strong connection to the die, such as a stiff solder. A second plate 330 may also be attached to the package 300, such as by an adhesive. (*See* Description, ¶0030)

In Figures 2 and 3, the first plate and the second plate are constructed of materials that are chosen to match the apparent coefficient of thermal expansion of a die with the coefficient of thermal expansion of a package. (*See* Description, ¶0031)

(vi) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1, 4, 6, and 7 are rejected under 35 U.S.C. §102 (e) as being anticipated by *Rinella.*

The Examiner has objected to claim 5 as being dependent upon a rejected base claim, and such claim would be allowable if the base claim is allowed.

The reason for the objection regarding claims 3 and 8-10 has not been articulated in the record, but it is assumed that the Examiner has objected to such claims on the same basis as claim 5, and that such claims are thus allowable if the base claim is allowed.

Claims 31-37 have been allowed and are not the subject of this appeal.

(vii) ARGUMENT

The Examiner rejected claims 1, 4, 6, and 7 under 35 U.S.C. 102(e) as being anticipated by *Rinella*. Appellant respectfully submits that such claims are not anticipated by the reference, and that the claims should be allowed.

Claim 1

Claim 1 reads as follows:

1. A microelectronic device comprising:
   a die, the die comprising a first side, a second side, and an edge;
   a first plate, the first plate coupled with the die, the first plate exerting force on the die to modify the effective coefficient of thermal expansion of the die; and
   a package, the die being coupled with the package.

This claim includes a first plate, with "the first plate exerting force on the die to modify the effective coefficient of thermal expansion of the die". Appellant respectfully submits that *Rinella* does not anticipate this element of the claim. *Rinella* relates to different device issues and is not related to modification of a coefficient of thermal expansion. *Rinella* does not discuss or address the concept of thermal expansion in any manner.

Rinella concerns certain integrated circuits. Specifically, *Rinella* may relate to an integrated circuit package having a heat dissipating structure to provide for heat dissipation from the surface of a die to an integrated heat spreader through a high capacity thermal interface. (*Rinella*, abstract) For example, *Rinella* describes an embodiment in which the front surface of a die is flip-chip mounted to an organic land grid array substrate. A high capacity thermal interface material is injected between the back surface of the die and an integrated heat spreader. In this example, a shaped mold

plate doubles as the integrated head spreader and acts to channel the interface material between the die surface and the mold plate. (*Rinella*, col. 3, lines 39-55) Thus, the devices or device elements presented in *Rinella* are designed to provide effective heat dissipation.

The structure and operation of the devices presented in *Rinella* may further be discerned by examining the figures and supporting text of this patent. In Figure 2, an IC package 100 includes a die 102 that dissipates heat through its upper surface by a thermal interface 122 to a combination mold and integrated heat spreader 120. (*Rinella*, col. 5, lines 56-62) The IC package 100 may further include a heat sink 114, possibly with heat fins 116, to further dissipate heat from the integrated heat spreader 120.

The integrated heat spreader 120 is also shown in a top view in Figure 3. As indicated, this element may be made of a thin sheet of thermally conductive material. The heat spreader includes a channel 128 across the heat spreader, which may be formed by a rolling or other operation that leaves channel boundaries 124. (*Rinella*, col. 6, lines 19-26) In this embodiment, the heat spreader 120 also includes an inlet 132 (not denoted in the Figure, but the text indicates that this is the round hole) and an outlet 134. (*Rinella*, col. 6, lines 27-32) In this top view, there is also shown an inlet ramp 133 and an outlet ramp 135. (*Rinella*, col. 6, lines 33-37) The inlet ramp 133 and outlet ramp 135 then can be seen in cross-section in Figure 4. The heat spreader may also be seen in detail in the figures of *Rinella* that describe the fabrication of this element, including Figure 8 (top view before hole punching), Figure 12 (top view after hole punching), Figure 14 (cross-section view), Figure 15 (top view after hole punching and partial formation of inlet ramp 351 and outlet ramp 353), and Figure 16 (cross-sectional view of fabricating machine and partially fabricated heater spreader).

In discussing the claims, the Final Office Action cites to the heat spreader element 120 of Figure 2 as the first plate in Claim 1. However, it is respectfully submitted that such element is not relevant to the claims. The heat spreader does not provide for "exerting force on the die to modify the effective coefficient of thermal expansion of the die". The heat spreader is a device that is instead intended to dissipate heat from a device and to serve as a mold for the injection of a thermal interface. There is no discussion in *Rinella* that relates to the intent to modify the effective coefficient of thermal expansion of the die.

Claim 1 provides for an exertion of force to modify the "effective coefficient of thermal expansion". Modifying the temperature of a die by dissipating heat from the die, such as accomplished by the heat spreader element in Rinella, does not affect the coefficient of thermal expansion of the die. The amount of expansion of the die could coincidentally be changed (because the temperature of the die has changed), but the coefficient of thermal expansion (relating to the how much expansion occurs as a function of temperature) is not changed.

The discussion in *Rinella* with regard to the technology of the invention is focused on heat dissipation. *Rinella* indicates that the die dissipates heat through its upper surface through a high capacity thermal interface 122 to the combination mold plate and integrated heat spreader 120. The heat spreader then includes a wall or support member that makes physical and thermal contact with the upper surface of the substrate through a thermally conductive adhesive. (*Rinella*, col. 5, lines 56-62) There is nothing in the discussion that relates to CTE characteristics.

Further, it is noted that the discussion of the integrated heat spreader in *Rinella* presents embodiments that are not intended and would not be applicable for modification

of effective coefficient of heat expansion. For example, in an embodiment of the heat spreader is described as "a relatively thin sheet of thermally conductive material", which in one embodiment is copper or an alloy with a thickness of 1.5 mm, with possibly a plating of nickel. (*Rinella*, col. 6, lines 5-12) A thin sheet of metal would not be expected to exert any substantial force on the die. The heat spreader has a different purpose and the embodiments described in *Rinella* are not described in manner that would be practical for CTE modification.

In short, *Rinella* addresses a different kind of issue for circuits, which is the manner in which heat is dissipated from a device. In contrast, modification of the coefficient of thermal expansion relates to how much a device expands as a function of temperature changes. These are very different physical phenomena.

In response to the arguments present by Appellant, the Examiner indicated the following in the Advisory Action:

> Rinella et al. disclose the first plate 120, the first plate coupled with the die 102, the first plate exerting force on the die. The structure of Rinella et al is identical to the claimed structure. Therefore, the claimed structure is at least inherent over the structure of Rinella et al. (cover fig.), such as: the first plate is exerting force on the die (cover fig.) and it is inherently to modify the effective coefficient of thermal expansion of the die.

Appellant respectfully submits that the statement of the Examiner is in error in several ways. There is no indication in *Rinella* that the "first plate" (integrated heat spreader 120) exerts force on the die 102. *Rinella* does not describe the physical connection between the heat spreader 120 and the die 102. As illustrated in the embodiment shown in figure 2, the edges of the integrated heat spreader 120 appear to

touch the die, but there is no indication that there is a connection that would exert force on the die. This is also shown in Figures 6 and 7 of *Rinella*, which illustrate the thermal injection machine and which include an illustration of the die 240 and the integrated heater spreader 230. In the descriptions of Figures 6 and 7 there is again no discussion of any force exerted on the die by the heat spreader. Further, Figures 18 describes processes relating to the formation of a device. In the description of this embodiment, *Rinella* indicates that the processes include positioning a die adjacent to a plate (*Rinella*, figure 18, element 604; col. 12, line 17) and not to a coupling or connection in a manner intended to provide force on the die. It is submitted that the structure of *Rinella* and the structure provided by claim 1 are not "identical", as state in the Advisory Action. As has been discussed above, *Rinella* provides a structure in which an element that acts both as a mold and as integrated heat spreader is placed adjacent to a die, without a coupling that would allow for the exertion of force.

Further, it is not true that *Rinella* is "inherent" over the elements of the claims. The claim not only includes "the first plate exerting force on the die", but also that this be "to modify the effective coefficient of thermal expansion of the die". Even if, for the sake of argument, it is assumed that *Rinella* demonstrates a plate exerting a force on a die, this does not inherently lead to a change in the effective coefficient of thermal expansion of the die. The effect of a force depends on at least the direction of the force and how the force is applied. There is no indication of a force in *Rinella*, and thus clearly no indication of a kind of force that would generate the claimed result.

As provided by the Federal Circuit, for a missing element to be found to be an inherent characteristic and thus support a rejection on the basis of anticipation, then extrinsic evidence of the missing element needs to be shown:

> To serve as an anticipation when the reference is silent about the asserted inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.

(Continental Can Co. USA v. Monsanto Co., 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991)) It is submitted that no such extrinsic evidence has been presented. It is further submitted that no such evidence is possible because an invention for providing for heat dissipation such as presented in *Rinella* does not inherently change the coefficient of heat expansion of the die. The dissipation of heat away from the die will affect the actual expansion or contraction of a die. However, this is because the amount of heat applied to the die may be reduced, not because the effective coefficient of heat expansion of the die has changed. It is noted that Claim 1 relates to the effective coefficient of heat expansion "of the die", and thus it is the characteristics of the die that are relevant here.

Other Claims

The remaining rejected claims 4, 6, and 7, while having other differences, are dependent claims and are allowable as being dependent on the allowable base claim. Appellant respectfully submits that absent any suggestion in this or any other reference of record, the respective claims are not anticipated.

The Appellant further states the following regarding the other rejected claims:

Claim 4 – Claim 4 includes "wherein the first plate comprises a hole, the die fitting within the hole, the edge of the die being coupled with an edge of the plate by the hole." The Office Action states that "*Rinella* el al. disclose that the first plate 102 [sic –

should be 120] comprises hole, the die 102 fitting with the hole, the edge of the die being coupled with an edge of the plate by the hole."

However, as shown above, in the described embodiments of *Rinella* the die does not fit in a hole in the integrated heat spreader. Rather, the die fits between the inlet ramp (for example, element 133 in Figures 3 and 4) and the outlet ramp (for example, element 135 in Figures 3 and 4). The heat spread does contain holes, such as inlet 132 and outlet 134 in Figures 3 and 4, but the die does not fit within these holes.

Claim 6 – For the microelectronic device provided in Claim 6, "a side of the die is coupled with a side of the first plate". The Advisory Action indicates that "Rinella et al. disclose that a side of the die 102 is coupled with a side of the first plate 120 (cover fig.)." It is submitted that the figure does not illustrate this, and instead illustrates the die touching the edges of the inlet ramp and outlet ramp of the heater spreader 120.

Claim 7 – The microelectronic device provided in Claim 7 includes "a second plate coupled with the package". The Advisory Action indicates "Rinella et al. disclose that a second plate 104 coupled with the package 100 (cover fig.)." It is submitted that a second plate is not shown in such figure. As indicated in the text, element 104 is the substrate, with the die being mounted to lands 106 on the upper surface of the substrate 104 through solder balls or bumps 105. The meaning of a substrate is well understood in the art, and the substrate does not represent the element of the claim.

CONCLUSION

Careful review of the Examiner's rejections shows that the Examiner has failed to provide any reference or combination of references that shows the claims. Therefore, Appellant respectfully submits that all appealed claims in this application are patentable and were improperly rejected by the Examiner during prosecution before the United States Patent and Trademark Office. Appellant respectfully requests that the Board of Patent Appeals and Interferences reverse the Examiner and direct allowance of the rejected claims.

This brief is submitted, along with a check for $500.00 to cover the appeal fee for one other than a small entity as specified in 37 C.F.R. §1.17(c). Please charge any shortages and credit any overcharges to our Deposit Account No. 02-2666.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Dated: July 25, 2005

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(viii) CLAIMS APPENDIX

The claims on appeal read as follows:

1. A microelectronic device comprising:

a die, the die comprising a first side, a second side, and an edge;

a first plate, the first plate coupled with the die, the first plate exerting force on the die to modify the effective coefficient of thermal expansion of the die; and

a package, the die being coupled with the package.

2. (Cancelled)

3. The microelectronic device of claim 1, where the first plate modifies the coefficient of thermal expansion of the die to make the coefficient of thermal expansion of die more closely match the coefficient of thermal expansion of the package.

4. The microelectronic device of claim 1, wherein the first plate comprises a hole, the die fitting within the hole, the edge of the die being coupled with an edge of the plate by the hole.

5. The microelectronic device of claim 4, wherein the edge of the die is soldered with the edge of the first plate.

6. The microelectronic device of claim 1, wherein a side of the die is coupled with a side of the first plate.

7. The microelectronic device of claim 1, further comprising a second plate coupled with the package.

8. The microelectronic device of claim 7, wherein the package is attached with the second plate by an adhesive.

9. The microelectronic device of claim 7, wherein the first plate and second plate are constructed of the same material.

10. The microelectronic device of claim 9, wherein the first plate and the second plate are constructed of copper.

11-30. (Cancelled)

31. A microelectronic device comprising:

a die, the die comprising a first side, a second side, and an edge;

a first plate, the first plate coupled with the die, the first plate comprising a hole, the die fitting within the hole, the edge of the die being coupled with an edge of the plate by the hole, the edge of the die being soldered with the edge of the first plate; and

a package, the die being coupled with the package.

32. The microelectronic device of claim 31, wherein the first plate exerts forces on the die to modify its effective coefficient of thermal expansion.

33. The microelectronic device of claim 32, where the first plate modifies the coefficient of thermal expansion of the die to make the coefficient of thermal expansion of die more closely match the coefficient of thermal expansion of the package.

34. The microelectronic device of claim 31, further comprising a second plate

coupled with the package.

35. The microelectronic device of claim 34, wherein the package is attached with the second plate by an adhesive.

36. The microelectronic device of claim 35, wherein the first plate and second plate are constructed of the same material.

37. The microelectronic device of claim 36, wherein the first plate and the second plate are constructed of copper.

(ix) EVIDENCE APPENDIX

None.

(x) RELATED PROCEEDINGS APPENDIX

None.